

WHAT IS CLAIMED IS:

1. A computer readable medium carrying one or more sequences of one or more instructions for execution by one or more processors, the instructions when executed by the one or more processors, cause the one or more processors to perform the steps of:

automatically inserting common cause basic events into multiple fault tree structures in a risk model stored in a computer memory; and

replacing regular basic events within the multiple structures with logic gates including two or more common cause basic events associated with the common cause failure group, the logic gates being based upon a single definition of a common cause failure group.

2. The computer readable medium of claim 1 carrying the one or more instructions, further causing the one or more processors to correctly sample probabilities associated with the common cause basic events when an uncertainty analysis is performed on the risk model;

wherein dependencies in the common cause basic events are accounted for and reflected in the risk model.

3. A computer readable medium carrying one or more sequences of one or more instructions for execution by one or more processors, the instructions for verifying a common cause failure model stored on a computer memory, the model including at least one event sequence diagram based upon a number of inter-related regular basic events, the instructions using one or more graphical user interfaces configured to display at least the event sequence diagram and the regular basic events, the instructions when executed by the one or more processors, cause the one or more processors to enable a user to perform the steps of:

forming a list including a number of common cause group member events, each corresponding to at least one regular basic event;  
selecting a number of rules to apply to the common cause group member events of the list;  
defining common cause groups based upon application of the rules, the common cause groups being formed of the common cause basic events; and  
introducing risks into the common cause failure model in accordance with the common cause groups.

4. A method for enabling a user to identify common cause failure groups within a software based risk model, the risk model being stored on a machine readable computer medium, the method comprising the steps of:  
permitting a user to display a list of existing common cause failure groups associated with the risk model via a graphical user interface; and  
permitting the user to modify the list using the graphical user interface.

5. The method of claim 4, further comprising a step of filtering to permit the user to display only selected common cause failure groups from within the existing common cause failure groups.

6. The method of claim 4, wherein each common cause failure group is associated with an event sequence diagram which schematically represents a sequence of events leading to a failure.

7. The method of claim 4, wherein the step of permitting the user to modify the list includes at least one of a sub-step of one of permitting the user to edit one or more of the existing common cause failure groups and creating one or more new common cause failure groups.

8. The method of claim 7, wherein the step of creating new common cause failure groups includes:

displaying a global list of regular basic events via the graphical user interface; and

permitting the user to create each of the one or more common cause failure groups by selecting group member events from the global list of regular basic events to form a member list of common cause basic events, the common cause group member events forming the common cause failure group.

9. The method of claim 8, further comprising the steps of:

displaying the common cause failure groups to the user via the graphical user interface;

providing a list of rules to expand the common cause failure groups via the graphical user interface; and

permitting the user to select a particular rule from the list to apply to the common cause failure groups for expansion into common cause basic events.

10. The method of claim 9, further comprising the steps of:

facilitating a customized expansion of the common cause failure groups based upon the particular rule; and

permitting the user to graphically display a preview of the customized expansion.

11. The method of claim 10, wherein the customized expansion

includes a display of selected ones of the common cause groups.

12. The method of claim 10, wherein the common cause groups are associated with one or more fault trees, and wherein the preview includes a display of the one or more of the fault trees.

13. A method for permitting a user to determine a probability of occurrence of a common cause group within a system risk model, the model including interdependent event sequence diagrams and being stored on a machine readable computer medium, the method comprising user initiated steps of:

graphically displaying a list of one or more models adapted for application to the common cause group;

wherein the user specifies parameters associated with a selected one of the one or more models; and

wherein the specified parameters are used by the models to expand the common cause group into a number of common cause basic events.

14. The method of claim 13, wherein the one or more models include at least one of an Alpha Factor and a Beta Factor model.

15. The method of claim 14, wherein each of the models requires an input of a number of model parameter values; and  
wherein the user determines the values.

16. The method of claim 14, further comprising a step of determining a probability that the common cause basic event will represent an independent failure and the probability that the common cause basic event will represent a dependent failure.

17. The method of claim 13, wherein the probability uncertainty values are associated with a total probability of occurrence of the common cause group.

18. The method of claim 13, wherein the common cause group is associated with a fault tree related to the selected event sequence diagram, the fault tree (i) being a graphical representation of inter-related combinations of regular basic events and common cause events and (ii) having a top event produced by an occurrence of the inter-related combinations, the method further comprising a step of determining a minimum number of occurrences of the inter-related combinations that produce the top event.

19. The method of claim 18, further comprising a step of determining the probability of occurrence of the top event.

20. The method of claim 19, wherein the steps of determining the probability of occurrence of the top event are based upon a Monte Carlo sampling scheme.

21. A method of expanding a fault tree in a risk model, wherein the fault tree includes a number of inter-related combinations of regular basic events and wherein the risk model is implemented in software stored on a computer memory, the method comprising the software implemented steps of:

- identifying an event sequence diagram associated with the fault tree;
- retrieving all common cause groups related to the event sequence diagram from the memory, each common cause group including a number of common cause basic events;
- determining whether the regular basic events are associated with any of the common cause groups; and

replacing each of the determined regular basic events in the fault tree with a logical operation, the logical operation having attached thereto two or more corresponding common cause basic event from within the number of common cause basic events.

22. The method of claim 21, wherein the logic operations are represented by at least an OR gate and an AND gate.

23. The method of claim 21, wherein the steps of retrieving, determining, and replacing are performed in accordance with one of a number of expansion models.

24. A system including a processor and memory, comprising:  
a first database stored in the memory and including a system risk model, the risk model including (i) at least one event system diagram and (ii) a number of fault tree definitions corresponding to the event system diagram, the fault tree definitions adapted to model an influence of system component failures upon the system, each fault tree relationship being formed of a number of inter-related regular basic events;

a common cause group defining mechanism configured to permit a user to define common cause group in accordance with the number of inter-related basic events, the common cause group defining mechanism including one or more graphical user interfaces to configured to (i) display defined common cause groups and (ii) permit the user to load the defined common cause groups into the first database, the common cause groups being defined in terms of common cause basic events, each corresponding to a regular basic event;

a fault tree data structure mechanism configured to define a fault tree data structure, the fault tree data structure being stored in the memory and

adapted to convey an interdependence between the stored fault tree definitions to form fault trees;

a common cause failure expansion mechanism configured to apply common cause failure expansion rules, the rules being stored in the memory and adapted to convey a union of the regular basic events and the common cause basic events;

wherein the processor is configured to apply the common cause failure expansion rules to the fault trees to produce an expanded data structure representative of an occurrence of the common cause basic events; and

wherein the expanded data structure is displayed to the user via the one or more graphical user interfaces.

25. The system of claim 24, further comprising a probability determining mechanism configured to determine a total probability of a common cause group and a probability of occurrence of the common cause basic events.

26. The system of claim 24, further comprising at least one graphical user interface configured to permit the user to control operation of the system.